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Session 1

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DEFORMATION, FLOW, AND SHEAR BANDS IN AMORPHOUS METALS

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Metallic glasses exhibit plastic deformation with a mechanism similar to that of shear flow in liquids. The flow is characterized by strain softening, strain rate hardening, and thermal softening. At low temperatures, or high strain rates, the flow exhibits spatial localization and shear band formation. Shear banding is a mode II or mode III type failure mechanism. Under unconstrained conditions (e.g. tensile loading),failure is often catastrophic and results in little global plastic strain before failure. To make amorphous metals useful in structural applications, one must suppress this type of failure. Examples of strategies to accomplish this will be discussed. Prospects for use of metallic glass as a structural material based on the introduction of a microstructure within the glass matrix will be described.

FORMATION AND MECHANICAL PROPERTIES OF CU-BASED BULK GLASSY ALLOYS

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A number of bulk glassy alloys containing Cu as a solute element have been developed for the last decade as exemplified for lanthanide-, Mg-, Zr-, Hf- and Ti-based systems. However, there have been no data on the formation of Cu-based bulk glassy alloys containing more than 50 at% Cu. Very recently, we have succeeded in finding Cu-based bulk glassy alloys with thickness up to 5 mm. The Cu-based bulk glassy alloys exhibit good mechanical properties, i.e. Young's modulus of 110 GPa, yield strength of 1800-1870 MPa and tensile fracture strength of 2000-2160 MPa. These mechanical properties are superior to those for Zr-based bulk glassy alloys. The supercooled liquid region reaches 50 K, which is larger enough to utilize the viscous flow working. These properties are promising for the future development as a new type of high strength materials.